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ABSTRACT

A two-stage project generated and tested a problem-solving linkage model of dissemination and utilization (DU) processes. The first phase involved the analysis of the DU activities of four Federal agency units in order to produce the model. The overall DU process was conceptualized as a dialogue between users with information needs and suppliers who provided the required information. The basic model created consisted of six function sets: 1) user self-servicing; 2) need processing; 3) solution building; 4) solution processing; 5) microsystem building; and 6) macrosystem building. Phase II of the project involved the application of the model to an applied research and development organization to determine if it would: 1) promote understanding of the perceptions of the DU process held by members of the organization, and 2) help predict the internal behavior of and applied contributions made by the organization. The model did accurately describe the activities of the organization and helped the organization's researchers conduct attitudinal self-assessments. It was concluded that the model assisted the researchers to see their own activities in model terms and it was recommended that additional research study the model's utility to user groups. (LB)

DEVELOPING AND TESTING A LINKAGE MODEL OF DISSEMINATION AND UTILIZATION

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DEVELOPING AND TESTING A LINKAGE MODEL OF DISSEMINATION AND UTILIZATION

INTRODUCTION

Research on the utilization of scientific knowledge can only be as good as the concepts, models, and theories on which it is based. We have had concepts for many years--extracted from the operations of real-life knowledge diffusers and users, and adapted from older, more general social science disciplines. On the other hand, none of us would claim that we have anything close to a theory of how research knowledge gets generated, disseminated, and put to use. We are somewhere in the middle, at the model building stage. The trick is to build models of dissemination and utilization ("D&U") which are sufficiently generalizable so that they can be used for more than description of the situations from which they were derived. That is, after we build a model descriptive of one D&U situation, we need to see if the model can relate to and predict behaviors of other systems.

In this paper we will describe the generation and testing of a "problem-solving linkage model" of D&U processes. Two separate studies are involved. The model was created to describe the D&U activities of four Federal agency units. It was then applied to help us understand the role of perceptions of the D&U process on the part of scientists in another government agency, and how these perceptions help us to predict their D&U environment and personal scientific and applied contributions.

DEVELOPMENT OF THE MODEL--THE "FOUR AGENCY D&U STUDY"

Late in 1971, Havelock and Lingwood (1973) began a project, sponsored by the Manpower Administration, DOL, with three objectives: (1) to describe the activities of four Federal agency D&U units,[1] (2) to study communication patterns within the networks of policy/research/application surrounding each unit, and (3) to create an opportunity for inter-agency comparison by the staffs involved.

The major task of the project was one of summarizing open-ended interviews with agency staffs, both inside and around the D&U units, which provided material descriptive of D&U philosophy and operations. Collecting the infor-

mation was simple enough. What proved more difficult was developing a coherent framework which would allow complete description, integration, and comparison of the four agencies, function by function. It became immediately apparent that the diversity of intra-agency, let alone inter-agency, responses was so great that none of the existing models of D&U could be used. For example, while a linear Research-Development-Dissemination model might handle the comments of one respondent, the next person (or the next agency) might be working extensively with user populations in a problem-solving mode, while the third might have based his thinking on diffusion theory, and so on.

A more macroscopic approach solved the problem for us. If we stepped back from the day-to-day activities, job roles, and attitudes of D&U staff, we could conceptualize the whole research production and utilization process as a problem-solving dialogue between an individual, group, or system with a need for research information, and individuals, groups, or systems who create or otherwise provide the needed knowledge. Dialogue implies two-way communication, or more important yet, conditional two-way communication. That is, in dialogue, person A's response to B is conditioned by what B has just said, and so on. This approach gave us a model which is level or situation free. It could be used in all four agencies and could cover the D&U activities of one person, or those of a whole system.

The basic model we[2] developed is shown in Figure 1. Let us work through the processes contained here from right to left. We begin with the user of research knowledge to stress our concern with application, rather than just dissemination of knowledge. If we start with the user we are concerned with his abilities to solve his own problems, become aware of needs he cannot meet alone, and express these needs to potential outside solution-providers. On the other hand, the user must have the capacity to seek solutions provided by outsiders, and adapt and integrate these to his situation so that they may be applied to alleviate needs. At this level of generality, "needs" may be for anything, not just for research. In fact, most of us or our systems go through great amounts of help-seeking/help-using without ever generating need statements which require the use of existing research, or the creation of new knowledge. Nevertheless, if there is a channel open, many important needs which cannot be answered locally do get transmitted to remote collections of research knowledge, and if these fail, to centers of research-creation expertise.

We said "if there is a channel open," bringing us to the first link between user and solution-source. This we call the need processing function. The steps in need-processing (as in solution delivery) become more complex as we move from dyads of people to interacting systems, but the generic processes remain the same. Beginning with the user's ability to generate and articulate a need, we move to transmission and re-definition processes linking user and solution sources. In the one-to-one case this may be as simple as two people agreeing on what the needs of one of them are, in terms understandable to both. In complex systems, there probably will be separate processes for need assessment, analysis, and channeling of needs to appropriate solution sources: policy makers, program administrators, or R&D. Since we are concerned with research knowledge, we will talk about only these needs from here on, other than to note that D&U units of agencies do get into the need sorting process, and require ways to send selected needs to policy or program units.

Solution building functions are on the left of the model. Obviously, the steps involved again depend on whether the research need can be met from existing knowledge, or if new research or development is required. If the knowledge exists, then there is a retrieval step which may be as simple as one person's memory, or as complex as search, retrieval, and synthesis of many diverse pieces of research. If the knowledge is found not to exist, then D&U units must become somewhat involved in the research creation process. Here the model becomes somewhat vague, since we did not have units which were sponsoring research (other than that on the R&D-D&U process--which is in itself a part of this set of functions). In general, however, D&U personnel must interact with the research and development communities to influence them to be more relevant to needs, and to become more active in encouraging utilization of their results.

Once solutions from R&D exist, they still must be taken back to the potential users. Historically, this has been a high-activity area in D&U at the Federal level. Many D&U systems started with an emphasis on dissemination of existing R&D rather than (as does our model) with real user needs. There are three distinct types of activity in solution processing. First, R&D knowledge must be transformed, in style and (sometimes) content so that it is

understandable by the user to whom it is targetted. Second, it must be transmitted on appropriate channels so that it indeed reaches the user. Third, the user must be helped to put the knowledge to use by translating it to his situation--thus completing the cycle back to our starting point. All three steps are necessary, though again they differ depending on the size of the systems involved. Historically, however, we have seen many examples of systems which began only with transmission activities, and then belatedly discovered the need for transformation.

The four processes we have described so far cover most of the "maximal" or "ideal" activities in D&U. We have added two more, however. The first, which we call microsystem building, was constructed to focus our attention on interpersonal research utilization. While the model could be applied to these separately, we wanted a way to present both the agency-system level activities and the person-to-person activities at one time. Perhaps, as well, there are some qualitative differences in microsystems which result from their face-to-face, real time characteristics which might be lost if we simply separated them and applied the four processes of the model. In the four agencies, we studied, microsystem activities included such things as direct interchange between researchers and users, R&D in which the user collaborated actively, and integrated programs of R&D and D&U. Experiences gained in these activities should, in the ideal system, be tapped to improve operations in the other four model areas, as well.

The final step in the model is the overview and monitoring function we have called macrosystem building. Regardless of the level or complexity of the D&U problem-solving process, someone or something must be set up to evaluate, compare, discover missing elements, and create activities to fill gaps. This becomes particularly important if we are talking about inter-organizational D&U activities, for example at the Federal level. An important part of this is learning from other similar systems. Finally, our concept of macrosystem building includes the tasks of promoting interchange, and creating an awareness on the part of persons involved that they are part of a total R&D-D&U system. While these steps are complex and difficult at the organization level, their analogy at the interpersonal level is the monitoring of process or interaction.

This, then, comprises the model we developed to categorize our learnings about the four D&U units studied. It would take us more time than is

available to describe how we coded our verbal data into the model, verified it with respondents, and presented it in side-by-side agency comparisons. We have, however, created "capsule summaries" of the activities of the four D&U units for each of the steps in the model, and these are included below. Before we can go to these we need a brief introduction to the four units so that the summaries can be read in context, considering the unit's location and mission.

THE FOUR D&U UNITS

(1) Division of R&D Utilization, Manpower Administration, DOL

A. Purpose: Based on DOL research designed to understand factors interfering with full, productive employment, and projects designed to improve employment, the DRDU was created from two earlier units in 1970. It has strived to make R&D knowledge available both to agency policy and program staff, and to gather innovative techniques and service delivery methods.

B. Staff & Support: As of November, 1971, DRDU consisted of seven professional and three clerical staff persons. DRDU is one of five divisions of the Office of Research and Development. DRDU works from the total R&D budget of ORD, and was administering $1.75 million in contracts, out of the total $23 million ORD budget, at the time of our study.

C. Activities: DRDU staff were active in R&D contract and grant work directly, and through "buddy system" links to other ORD research project officers. About half of the staff's time was devoted to these linkages, through which they help define D&U strategy and appropriate user groups for project outputs. Staff were also active in summarization of results, distribution inside and outside of their agency, and R&D and evaluation of D&U itself.

(2) Research Utilization Branch, Social and Rehabilitation Service, DHEW

A. Purpose: RUB has come, since its creation in 1967, to be a focus for D&U activities in the area of vocational rehabilitation, and recently, in other SRS program areas such as welfare research and aging. RUB's major goals include: improvement of agency R&D information activities, impact on the conduct of research to insure the usefulness of outputs, to link R&D to practice settings, and to create new knowledge about D&U while planning an overall research utilization system for the agency.

B. Staff & Support: During our interviewing, RUB was made up of four professional staff, though the unit has expanded somewhat during its change to Division status. RUB works from R&D money pooled in the Office of Research and Demonstrations, which now coordinates all SRS research.

C. Activities: Responsibilities of RUB have expanded over time to include utilization efforts, telecommunications, and guidance for development of an SRS-wide information system. Staff activities can be categorized in three broad areas: policy formulation, planning and development of intramural and contracted R&D-D&U efforts, and contract management for D&U projects. As we will see in the model-step comparisons below, the staff also have been directly involved in repackaging and dissemination.

(3) Mental Health Services Development Branch, NIMH, DHEW

A. Purpose: This unit has three objectives: evaluating problems and needs in mental health service delivery, solution development from existing or research knowledge, and fostering D&U for these solutions. MH Services is also an amalgamated unit (as are the MA and SRS units), having been formed from earlier applied research and mental health service-support programs. The dual history survives in staff expertise and activities.

B. Staff & Support: At the time of interviewing, the branch consisted of about 18 professionals with expertise in a variety of areas (e.g., psychiatry, psychology, social work). The branch was operating with a research budget of about $10 million, plus additional funds for publications, conferences, and direct client consultation (e.g., with community mental health centers).

C. Activities: The work of the branch fits in three broad areas: consulting in the field with grant applicants, mental health centers, etc.; serving as a base of information and expertise within NIMH through internal reports, task force assignments, etc.; project monitoring. The unit is organized by program areas, with a staff member assigned to each according to skills (e.g., children's mental health); the staff member coordinates all activities in that substantive area.

(4) National Center for Educational Communication, Office of Education, DHEW

A. Purpose: NCEC had ("had" since it is now a part of NIE) the mission of: fostering D&U of validated educational innovations, strengthening state and local D&U capabilities, increasing agency and public access to educational R&D knowledge, and supporting R&D on the D&U process itself.

B. Staff & Support: At the time of interviewing NCEC was planning for a FY 1973 funding base of almost $15 million, with about $9 million allocated for the educational extension program, and the rest for communication support activities. There were 28 professional staff in NCEC, with backgrounds in information services, teaching, and school administration.

C. Activities: NCEC staff activities vary according to the particular unit within which members worked. Staff members in the Extension Support Branch sponsored much of the R&D in the area of D&U, and also evaluations of NCEC itself. Communication Support staff were divided among the Educational Resource Information Centers (ERIC), and the Educational Reference Center, which provided direct information services such as computer searches for OE and DHEW staff.

These brief summaries are not intended to cover the broad range of work in the four units, but will help us to interpret their activities as we summarize them according to the steps or "function sets" of the D&U model. We will approach each function set in three ways: first, we will list the "maximal" set of activities which might be included within that functional step by a fully-functioning D&U organization. We must note that we do not mean to imply that the particular units we have chosen for study should be involved in all of the maximal activities. Rather, these are tasks which probably need to be done somewhere in the fully-functioning D&U system.

Second, we will present capsule comparisons of what we heard in our interviewing in each unit, things we could code as activities covered in the particular step of the model. These capsules are themselves vastly shortened versions of comparisons in the study report (Havelock and Lingwood, 1973), and we refer the interested reader to this source for more complete listings of activities.

Finally, we will offer a briefer-still comparison of the four units, trying to extract overall trends and more abstract statements about D&U. We have tried to be as non-evaluative as possible in these comparison statements.

A. SUMMARY COMPARISONS OF THE FOUR D&U UNITS

Function Set #1. User Self-Servicing

MAXIMAL: An effective and progressive user self-servicing subsystem has a good localized problem-solving capacity, maintains a continuing awareness of its needs, present and future, knows how to express its needs to potential resource persons and groups, looks outward and inward for innovations, and is able to adapt new ideas. Maximal D&U activities in this area would focus on helping the user help himself by providing training or support on any of the above sub-processes.

MA: Very little process helping is provided by the Division of R&D Utilization in the form of training or techniques for receiving or using knowledge; however, several Job Coaching manuals that have been developed or sponsored potentially serve this function.

SRS: Although the Research Utilization Branch does not have sole responsibility or resources and capacity to fulfill user self-servicing functions, they do attempt to link up to such efforts of other units in SRS. For example, RUB has played a major role in training efforts among the Research Utilization Laboratories and the Research Utilization Specialists. Much of this training has been oriented toward building human relations and problem-solving skills and is user-centered in emphasis.

NIMH: In the Mental Health Services Development Branch, user self-servicing is promoted by staff consultation to community mental health centers, "how to" manuals focusing on problem-solving procedures, and projects concerned with techniques of training for planned change.

OE: Although developing user self-servicing is not central to the mission of the National Center for Educational Communication, there is an emphasis on training local intermediaries as special process helpers; the extension agents are supposed to serve as one method to give users technical and programmatic assistance in locally-initiated problem-solving activities.

COMPARISON: Across the four agencies, access to clients varies as a result of historical relationships with clients, mandated posture to them, size of the units, and level and extent of activity of the client groups themselves. User self-servicing activities range from NIMH's consultation work with clients to MA's past mission-dictated separation from line activities at the state and local level. Relative size of client groups to available D&U unit staff also appears to be an important factor.

Function Set #2: Need Processing

MAXIMAL: Maximal D&U functions in the area of need processing would include various activities required to communicate user needs to resource persons and systems. Transformation activities such as need arousal, need sensing, need definition, and needs assessment are necessary for transmission of needs to policy makers and to the R&D community. Additional specialized transformations include the translation of need priorities into research and development programs with dollar authorizations and into problems amenable to R&D.

MA: Staff of the Division of R&D Utilization feel that they do not have primary responsibility for need processing or for determining the direction of the R&D program. ORD, as a whole, is responsible for need processing and the planning of future R&D programs; the Division generally applies its knowledge of user needs in relating users to products of the R&D program.

SRS: The Research Utilization Branch is involved in the Operational Planning System of SRS which allows for annual updating of objectives and design of research proposals to meet these objectives. Although not the direct responsibility of RUB, needs are transmitted to various policy makers by means of the yearly R&D Strategy; other means of transmission include the R&D Brief Series, RU Specialists, and the "Bidder's Conference."

NIMH: Need processing activities in the Mental Health Services Development Branch appear to be heavily influenced by researchers and by staff members working in consultation both with researchers and with mental health personnel. Although most need processing activities are carried out on an informal basis, more formal efforts include peer review panels and Branch-sponsored needs assessment projects.

OE: In general, need processing activities in the National Center for Educational Communication seem to be stronger in the area of need transformation than in the area of need transmission. Although user need input is stressed in NCEC programs and projects, priorities are written into legislation and come down from the highest level.

COMPARISON: In general, it appears that the four D&U units are only peripherally active in need sensing which has the objective of producing new R&D. The units do not serve as need monitors for their agencies' research programs; policy makers or researchers themselves tend to assume this responsibility. There is more need sensing activity in the units for their own clients, and for the research the units produce. NIMH's closer link to its smaller number of clients results in the greatest activity as need-sensor. Two of the units (NIMH and OE) have undertaken formal need sensing studies with clients in the field; MA's and SRS's activities are formalized in the agency planning process, but not vis a vis field clients.

Function Set #3. Solution Building

MAXIMAL: Although most solution building functions lie outside of the domain of D&U, three processes can be identified as maximal D&U activities in this area: influencing R&D to be more relevant to society; influencing R&D to be more disseminable and utillzable; and research on the process of utilization itself.

MA: Staff members of the Division of R&D Utilization are able to apply considerable pressure toward relevance and utilization of certain applied research and demonstration projects through involvement in the "buddy system" and also by intervention in final report writing for projects. Several efforts have been made to conduct R&D on the D&U process, although many of these efforts have been more concerned with the improvement of D&U practices than with the D&U process itself.

SRS: Guidelines developed by the Research Utilization Branch for final report writing and "instructions" for grantees to include utilization requirements in their research proposals have influenced R&D output to be more usable and relevant. RUB has sponsored an evaluation of the RU Specialists plus other projects designed to improve the process of dissemination and utilization.

NIMH: Indicative of the pressure toward relevancy and utility of R&D in the Mental Health Services Development Branch is the list of criteria used by review panels in evaluating research proposals; this list, developed in a Branch-sponsored project, includes items on project relevance and utilization. Although there has been some difficulty in obtaining funds for research on the D&U process, several projects have been sponsored that have had effects on Branch operation. The Branch has no influence on research performed elsewhere in NIMH.

OE: In the National Center for Educational Communication, pressure toward relevancy and utility of R&D is encouraged through proposal negotiation and in the development of new program areas but this influence does not extend to the bulk of the U.S.O.E. R&D effort. The application of R&D in the area of D&U is one of the five specified objectives of NCEC and staff have been very active in both producing and using research on D&U.

COMPARISON: All four units have made some impact on the relevancy of research through the guidelines, suggestions, etc. added to research proposal requirements; a somewhat greater impact on disseminability of research has resulted from requirements for final reports. There has been more success closer to home (i.e., in the R&D funded by the units), and only in the recent past have the units begun to have their guidelines imposed on all of the research sponsored by their agencies.

Function Set #4. Solution Processing

MAXIMAL: Maximal D&U activities in the area of solution processing would include steps designed to move a valid solution idea into implementation in a user system. Such functions as transforming knowledge into usable forms, transmitting knowledge to appropriate audiences, and helping people to use knowledge would be subsumed under solution processing.

MA: The Division of R&D Utilization is probably strongest in the area of knowledge transformations; packaging, tailoring, and targetting R&D findings to specific audences is a primary concern as is screening for quality materials. Although the Division maintains an in-house, manual system of storage and dissemination which generally allows them to provide documents at any time, this system operates exclusively for those products that have come out of its own R&D program and tends to be used most extensively by university R&D persons rather than practitioners or administrators. The Division does not have the resources to be a "user helper" beyond individual, informal cases.

SRS: Knowledge transformations conducted by the Research Utilization Branch include such products as the R&D Brief Series, two-page summaries of selected projects that spell out implications for users; tailoring to specific audiences seems to be a major Branch concern. Transmission activities are not as well delineated as are transformation activities; however, RUB is in the process of developing an SRS-wide information system, and has developed a guide on how to use other existing information systems. In terms of user helping, RUB acts as a linker to the various attempts at this function as performed by other units within SRS.

NIMH: Although the Mental Health Services Development Branch has not concentrated its efforts in the area of knowledge transformation, two new magazines, Innovations and Evaluation, have been designed as transformation devices. In terms of transmission activities, Branch efforts are handicapped somewhat by the decentralized nature of NIMH; however, staff members employ both formal and informal means to insure that knowledge reaches relevant audiences. Manuals, field consultation visits, and training projects are designed as user helping mechanisms by the Branch.

OE: Within the National Center for Educational Communication, the Educational Resource Information Center (ERIC) carries the bulk of transformation activities for the D&U unit. In many respects, ERIC is a model system equipped to do all of the print-based archival, integrative, and transformation functions necessary to give users complete access to the storehouse of knowledge in a major social problem area. Although transmission activities are not as strong as transformation activities in NCEC, there is a trend toward increasing the realm

of these functions. NCEC employs various means to help users implement innovations based on R&D; for example, a system of extension agents will be expected to provide developmental assistance to local educational practitioners as part of their role.

COMPARISON: Three of the four agencies, MA, SRS, and OE, are strong in the area of knowledge transformations. None of the four D&U units are as heavily involved in transmission activities. SRS, NIMH and OE provide some user helping functions in terms of consultants and linking agents.

Function Set #5. Microsystem Building

MAXIMAL: Microsystem building refers to activities in which many elements of the problem-solving dialogue are simultaneously present and are allowed to interact on a small scale. Maximal D&U functions in this area would include interchanges between researchers or developers and users, user-collaborative R&D, and integrated RDD&U programs.

MA: In the Division of R&D Utilization, emphasis is placed on interchange situations, although these now occur on an informal basis. User-collaborative R&D also is stressed in the Division: in the model of "projects as disseminators," user involvement is encouraged in the early stages of projects. A good example of integrated RDD&U programs supported by the Division would be the Experimental Manpower Laboratories set up in priority areas of needs.

SRS: The Research Utilization Branch is beginning to experiment with the use of researchers "on-demand and on-call"; other such interchange situations are also promoted by RUB as are user-collaborative R&D projects. Examples of integrated RDD&U programs include that of the Public Assistance in Vocational Rehabilitation program and various activities of the Research Utilization Laboratory in the Jewish Vocational Service.

NIMH: Of the three functions subsumed under microsystem building, the Mental Health Services Development Branch appears to be strongest in the area of integrated RDD&U programs. The most salient example of such programs would be Branch efforts directed toward the children's area priority. The Branch has also sponsored some user-collaborative R&D projects, and although interchange activities have been encouraged, limited funds have prevented the Branch from being able to develop the full potential of these interchange situations.

OE: The National Center for Educational Communication appears to have had little direct involvement in microsystem building between researchers and practitioners throughout the educational establishment. However, increasing attention is

being paid to the role of NCEC in this regard, and efforts toward building user-collaborative R&D and integrated RDD&U programs are being recognized as necessary prerequisites to user installation of R&D products.

COMPARISON: For microsystem building, system complexity appears negatively related to the proportion of effort expended in interchange and combined R&D and RDD&U projects. OE, in particular, had fewer such activities, although it is moving in that direction. The other three agencies, especially MA and NIMH have engaged in diverse activities involving these functions.

Function Set #6. Macrosystem Building

MAXIMAL: Although most macrosystem building functions lie outside the domain of any particular unit within an agency, several processes can be identified as maximal D&U activities in this area: modelling of the macrosystem, monitoring of the macrosystem, promoting linkage, filling recognized gaps, and building system awareness.

MA: The Division of R&D Utilization stresses the development of informal linkages within the Manpower Administration; one method used for this purpose is the "buddy system." Linkage between macrosystems is also emphasized. These linkages are helpful in terms of building awareness of the utilization system and in macrosystem modelling. Utilization laboratories have been supported where research, dissemination, and research on utilization can go on simultaneously with longer-term planning and funding.

SRS: The Research Utilization Branch has been working toward the development of an SRS-wide utilization system; however, lack of a common perception of the system has been a problem. RUB has stressed the importance of building networks and has served as a catalyst in many SRS efforts, e.g., research utilization specialists as linkers to the states. No unit in SRS has responsibility for building system awareness, although it appears that the new management procedures may be directed at this function.

NIMH: The Mental Health Services Development Branch is not in a position to engage in macrosystem building for NIMH; although there have been some efforts by NIMH as a whole to do this, past efforts have not been in the area of D&U. However, Branch members are participating in a newly-formed Study Group that is concerned with the problems of linkage and D&U in the NIMH system.

OE: The National Center for Educational Communication has done a great deal of gap filling and institution building. The network of specialized linking agents based in state agencies and the nineteen subject area clearinghouses within the ERIC system are examples of macrosystem building activities. In

terms of system mapping, a study of the educational information need sensing network has been funded as has another national survey of innovation process and information use in school districts.

COMPARISON: There is quite a bit of variation in D&U unit activity in the area of macrosystem building. SRS and NIMH have been less active, comparatively, but for different reasons: in SRS the difficulty has been the lack of an integrated system to be modelled; in NIMH it is perhaps the difference in approach between the D&U unit and the majority of NIMH subsystems which is the cause.

As an overview, the model has proved to be a great help in categorizing D&U activities of the four agencies. Each step shows relevant diversities among them, and in addition, highlights areas where there has been limited activity in any agency.

The scarcity of entries in two of the model steps in particular, need sensing and user helping, give testimony to the top-down, linear approaches to knowledge utilization which have been popular, at least in the past, in many agencies. Some agencies are, however, working their way through the model activities in reverse order in their attempts to increase utilization: D&U began as a dissemination arm, then became involved in translation activities and, ultimately, attempts to influence the relevance of R&D projects. If this trend continues, we would expect maturing D&U units to make more and more effort to generate or link to need sensing efforts, and to couple the results with their R&D relevance-building. User helping appears limited by client group size given the smallness of Washington-based D&U units and their remoteness from practitioners in the field. With the push toward decentralization, however, the units may become involved in wider agency efforts to provide training help to regional or state staff geared to direct user helping.

Thus, the model has proved useful for us in this study. The question remains, however, as to the utility of the concepts in each of the model steps for other studies in different systems. Let us turn to what we have learned in the first attempt to generalize and test the model.

TESTING THE MODEL--THE RESOURCE SCIENTIST STUDY

For the past three years Morris and Lingwood (e.g., 1973) have been involved in an action-research project with a major Federal natural resource agency. The project uses a guiding model of organizational problem solving in

R&D organizations, which sets up a problem-solving sequence for each of four major topic areas: organizational long range planning, organizational factors common in "OD" research, individual scientist factors (of background, motivation, team and organizational fit, satisfaction, and productivity), and finally, D&U itself. Our approach has been that of locating those areas this applied R&D organization sees as creating the most difficulties, then moving through problem solving to help the system improve its performance.

Although we cannot give complete detail of this work here, it is sufficient for our purposes to indicate that research utilization--actually getting research products put to use "on the ground" with resource managers--proved to be the area of major concern in the organization. Thus the project is in the interesting position of conducting research on D&U in the organization, then (in the action component) disseminating our findings to the organization and helping them put it to use, and finally evaluating our own utilization steps. Needless to say, the D&U model we have been discussing is thus both an object of our study, and a mirror by which we can see our own activities.

The major data collection activities of the project have centered around a self-administered mailed questionnaire sent to a census of scientists, team leaders, and administrators (plus a 1/3 sample of technicians).[3] The instrument was developed with heavy dependence on prior research on organizations, scientists, and D&U, and also drew heavily on the results of a full year of problem formulation interviewing we conducted throughout the system. In the area of D&U we were interested both in the applied and scientific output of the individual, and in those organizational and individual factors which should predict output. The D&U model was adapted to provide ratings of scientists' evaluations of present and ideal D&U activities within their research station. These ratings of activities, as filtered through the model, will be the focus of our concern for the rest of this paper.

There are two sets of questions involved: first, how do indices of the model steps (both ideal and actual) relate to other indices of the organization's and individual's D&U-related behaviors; and second, how well can the model-derived ratings of D&U predict scientists' scientific and applied contribution in their field and client groups. We developed a set of items from all of the model steps except macrosystem building (which we felt was too remote an activity to be particularly relevant to scientists). Solution building

items focussed on the concept of doing client-centered research.[4] Below we will relate the model-step indices to other D&U indices, and then to contribution, controlling for other relevant individual and organizational variables.

(1) The Relation of the D&U Model to Other D&U-Related Measures

Since the application of knowledge is such a pressing concern within the organization,[5] we developed several different sets of measures to cover the area, beyond the model indices themselves. Particularly relevant questions covered:

1. the importance of user problems to scientists,
2. the opportunity they feel they have to work on those problems,
3. the extent to which scientists are stimulated by users and their problems, and
4. the degree to which they feel their immediate organizational context supports D&U and client helping in general, and their own utilization activities in particular.

We would like to know how well the D&U model indices relate to these factors, controlling for personal and job-related differences of scientists and team leaders. Table 1 contains the answer.

The meaning of the D&U model indices needs some clarification here. For example, the "actual" "User Problem Solving and Helping" index (the top line in Table 1) indicates the extent to which the respondent thinks scientists in his research station are engaged in these activities now, and the "Ideal" index measures the extent he thinks they should be involved in such activities.

The partial correlations here indicate that those who think the D&U model steps are more important, as an ideal, also indicate they get more stimulation from their clients, and think user problems are more important. The correlations for the "Actual" D&U steps (as they are now) are much more modest. Perhaps there are constraints in the organization and/or the reward system which limit the ability of scientists to respond to client needs, thus attenuating the "Actual" measures' power to relate to client stimuli and client problem importance. The ideal measures may be free of such constraints.

Conversely, those who rate actual D&U higher now are those who have greater present opportunity to work on user problems. Again, the ideal-actual differences show up across all of the model indices. If we look at the two indices of importance of and opportunity to work on user problems, we see the kind of convergence we would hope to find: ratings of actual D&U, in model terms, correlate best with opportunity, while ratings of ideal D&U correlate best with importance of user problems.

Finally (in the last column of Table 1), we see that the scientists' perceptions of the degree to which their organization supports D&U and their efforts in this direction correlates reasonably well with ratings of actual D&U in the five model areas. Again, the actual ratings correlate better with the index of organizational D&U than do the ideal model indices.

Thus, we have found that indices representing the model do correlate to a moderate degree with other measures of D&U, and that there is a convergence between model "ideal" perceptions and (at least one) separate measure of ideals (the importance of user problems), and between ratings of actual D&U and other measures of present D&U conditions in the organization. On this level, at least, the model seems to "work" as we would hope.

We have not discussed differences across the model steps. There are minor differences in the correlations in each of the columns of Table 1 which are explainable. For example, actual microsystem building is the best of the actual model measures in terms of correlation with stimulus from clients. Our interviewing has found that informal, direct interchange between scientist and client is the most frequent way linkage is accomplished, when it is done at all. If this is so, stimulation from clients should come primarily through this mechanism, and the "actual" model correlations seem to bear this out. Overall, however, the model indices seem to operate very similarly, in their ideal and actual sets, in terms of their correlations to other D&U measures. We know, also, that there are very high correlations among the model-derived indices. It is difficult to say whether the indices are poorly conceptualized and incapable of controlling distinct variation, or whether it is simply the fact that persons who see ideal or actual D&U as high or low in one model step also see other steps the same way.

(2) The Relation of the D&U Model to Scientific and Applied Contribution

The next question is the extent to which the model steps relate to the contribution of the individual to his field and to applications. We have developed two parallel measures for scientific and applied contribution which will be used here, and which are major criterion measures in our work. These measures combine appropriate written outputs, events attended, and perceptions of contribution of past and present work.[7] We would hope that the D&U indices correlate better with the applied contribution measure than with scientific contribution.

Before we can have any degree of confidence in the correlations, however, we must control for personal and job-related characteristics which are known to relate to both the D&U indices and to contribution. Also, there is a .50 correlation between applied and scientific contribution, so we will need to "purify" each contribution measure by controlling for the other. The correlations are given in Table 2.

Let us look at the D&U index relations with scientific contriubion first, even though we had no specific predictions for these correlations. We find that those scientists and team leaders who are higher in scientific contribution say actual need sensing is done better in their stations, but they are lower in terms of the extent to which they think doing client-centered solution building is an important ideal. These findings may be clarified somewhat: there was no exact definition of who "clients" are, at least within the D&U model items themselves. High scientific contributors may well be thinking of other researchers as their primary client groups for the need-sensing items. The Client-Centered Solution Building items were, however, more closely specified as referring to "on the ground" land manager clients.

Different results occur for the relations of the D&U indices with the man's applied contribution. Independent of personal and job factors, and of scientific contribution, those respondents who are making greater levels of contribution to applications rate their stations higher, and consider the ideal activity as higher in the areas of need sensing, doing client-centered research, and microsystem building. In addition, applied contribution is greater among those who think translation and transmission are more important in the ideal, although there is no relation for current stations activities in this area.

Thus, all of the D&U index areas except user problem solving and helping appear to have some modest independent relationships to the scientist's applied contribution. The lack of relation for problem solving might be organization-specific in that the agency has not stressed direct help for clients beyond microsystem activities such as workshops, consulting, etc., and much reliance is placed on "how to do it" publications.

None of these correlations are large, especially compared to organizational and individual predictors of contribution. We should expect to find somewhat greater correlations for "ideal" ratings if there is a strong relationship between attitudes and action, since individual behaviors in each of

the five index areas would be defined as exactly what we mean by applied contribution. The rather abstract question wording (couched in terms of what the station's researchers actually do and should do) might account for some of this slippage. Nevertheless, we need to do additional work to determine the adequacy of the model as a whole for describing researcher-client linkages, and we need more careful operationalization of model-related items when we choose to work at the attitudinal level.

CONCLUSION

We have traced the development and field testing of a generic problem-solving D&U linkage model. We have shown the richness the model is capable of capturing in describing D&U activities on the non-quantitative level, and have found some, if a more limited, use for the model concepts when they are translated to attitudinal measures forself-assessment by researchers. Clearly other studies are needed in both areas. We also need to test one additional application of the model; that is, its understandability to client groups themselves as we seek to get our own knowledge put to use.

Our experiences in the four-agency D&U study showed that agency staff could understand the model, and adopt its terminology into their own thinking. As with any model, however, we did find some individual resistance to any attempts to abstract into categories what people do on a day-to-day basis. In the natural resource research agency study the results are not yet in, but we will be returning to the various research locations to feed data back and to help both researchers and managers understand the complex issues of research utilization. Beyond this, however, we have begun to see some use of the model in that "client" system which is perhaps the most difficult to influence of all: social scientists themselves. That is we have begun to see our own D&U activities in model terms.

FOOTNOTES

1. The four units were: (a) The Division of R&D Utilization, Manpower Administration, Dept. of Labor, the sponsor of our project. (b) The National Center for Educational Communication, Office of Education, DHEW. (c) The Research Utilization Branch, Social and Rehabilitation Service, DHEW, (d) The Mental Health Services Development Branch, National Institute of Mental Health, DHEW.

2. The editorial "we" here masks the fact that the model was the product of long hours on the part of Ronald G. Havelock. The rest of the project staff (Lingwood, Ms. J. Freund, and Ms. B. Ramirez) helped in the refinement and polishing of the model. Ms. Ramirez prepared the summary comparisons of the four D&U units which we will present later in the paper.

3. The overall response rate for the survey approached 94 percent.

4. Respondents answered each of the following items twice, first for the extent to which researchers in their station did these activities now, and once for the extent they should be doing these activities. The items were:

User Problem-Solving & Helping:
- "Helping user groups develop a capacity to solve their own problems."
- "Finding someone in each user group to help in dissemination and implementation."

Need Sensing:
- "Developing and using regular mechanisms for determining what users' needs are."
- "Transforming users' needs into problem statements and researchable questions."

Client-Centered Solution Building:
- "Doing research which is directly applicable 'on the ground'."
- "Doing work on problems at the time they are most important to users."

Translation and Transmission (Dissemination):
- "Producing summaries, abstracts, and reviews of research findings."
- "Rewriting research products in the language of each important user group."
- "Determining who the important users should be for each finding to be transmitted."
- "Selecting the most appropriate channels to be used to reach each user most efficiently."

Micro-System Building:
- "Designing ways to get users and researchers working together on joint projects."
- "Organizing ways users and researchers can get together to exchange information."

The grouping of items into indices was accomplished through joint use of conceptual item placement and empirical factor and cluster analyses.

5. We can underscore the verbal concern of top levels of the organization with the findings that assistant directors of the research stations were consistently higher than team leaders, who in turn usually scored higher than scientists, on most of the items relating to the importance of D&U.

6. These indices were composed of the following items:

Stimuli from Clients: (extent stimulated to perform well by)
"Problems arising in practical applications."
"[intra-organizational land manager] user groups."
"User groups outside of the [agency]."

Importance of User Problems (importance would attach to each of these factors of the job):
"To work on problems of central importance to the station."
"To work on problems of central importance to the station's user groups."

Opportunity to Work on User Problems: ratings of the items above in terms of how much opportunity the man's job provides to do each.

Organizational D&U: (agreement with the following, as opposed to their polar opposites)
"My location makes contact with the rest of the station very easy."
"There is persistent and strong pressure from outside my unit to ensure that its results find follow-up or practical application."
"Unit staff often serve as consultants with user groups regarding applications of our work."
"[the agency's] leadership encourages and rewards me for getting 'on the ground' applications of my research."

7. The Scientific Contribution index weights equally contribution in each of the three areas below:

Scientific Output: books and book chapters, abstracts and reviews, articles in journals, scientific station publications, and meeting papers or presentations (number in past five years).

Scientif c Events: regional or national, and international meetings or symposia, workshops and seminars, which were scientific or technical in nature (measured over the past two years).

Scientific Contribution Attitudes: Agreement with the statements, "My present work is likely to make a very substantial contribution to scientific or technical knowledge in my field," and, "My unit has made an outstanding contribution to scientific or technical development in its field."

Applied Contribution equally weights these three areas:

Applied Output: popularized articles, "how to do it" station publications (number in past five years).

Applied Events: number of researcher-user workshops and seminars, public meetings and hearings, user interest group meetings, and planning meetings in public or private sector (number in past two years).

Applied Contribution Attitudes: Agreement with the statements, "My present work is likely to make a very substantial contribution to practical application or use 'on the ground,'" and, "All of my unit's research results find follow-up or practical application."

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Figure 1

D&U Linkage Process Model

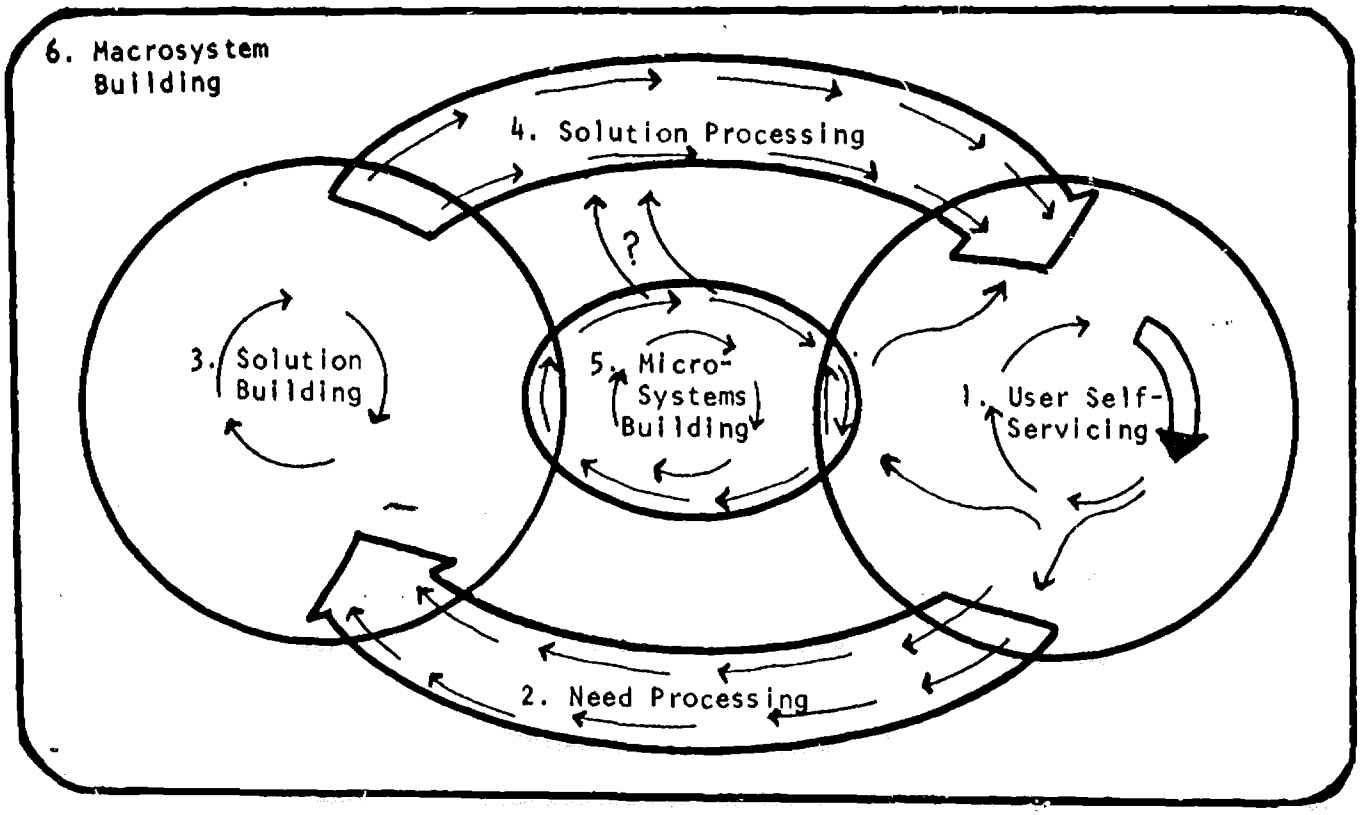

Table 1

Partial Correlations Between D&U Attitudes and Other D&U-Relevant Indices*

(Data from 707 natural resource scientists and team leaders.)

D&U Model Indices:		Other D&U-Relevant Indices: Stimuli from Clients	Importance of User Problems	Opportunity to Work on User Problems	Organizational support for D&U
User Problem-Solving/Helping	Actual	.08[a]	.09[a]	.16[b]	.20[b]
	Ideal	.15[b]	.21[b]	.10[b]	.07[a]
Need Sensing	Actual	.09[a]	.04	.27[b]	.31[b]
	Ideal	.22[b]	.18[b]	.05	.02
Client-Centered Solution Bldg.	Actual	.11[b]	.08[a]	.21[b]	.29[b]
	Ideal	.31[b]	.30[b]	.10[b]	.08[a]
Solution processing Channels	Actual	.03	.06	.19[b]	.22[b]
	Ideal	.17[b]	.20[b]	.10[b]	.11[b]
Microsystem Building	Actual	.15[b]	.11[b]	.27[b]	.37[b]
	Ideal	.26[b]	.27[b]	.10[b]	.12[b]

a = $p \leq .05$; b = $p \leq .01$

* These correlations are partialled on the following variables:
  --level of education
  --years experience in the research organization
  --hours worked per week
  --job title (scientist vs. team leader)
  --G.S. Grade

Table 2

Partial Correlations Between D&U Model Indices and Scientific and Applied Contribution

(Data from 727 natural resource scientists and team leaders.)

		Scientific Contribution	Applied Contribution
D&U Model Indices:			
User Problem Solving/Helping	Actual	.07	.07
	Ideal	.03	.05
Need Sensing	Actual	.12[b]	.08[a]
	Ideal	-.03	.10[b]
Client-Centered Solution Building	Actual	.03	.10[b]
	Ideal	-.11[b]	.22[b]
Solution Processing Channels	Actual	.08[a]	.03
	Ideal	.06	.13[b]
Microsystem Building	Actual	.09[a]	.13[b]
	Ideal	.02	.17[b]

a = $p \leq .05$; b = $p \leq .01$

* These correlations are partialled on the following variables:
  --level of education
  --years experience in the research organization
  --hours worked per week
  --job title (scientist vs. team leader)
  --G.S. Grade

  In addition, correlations involving Scientific Contribution are also partialled on Applied Contribution, and conversely, correlations involving the Applied Contribution are partialled on Scientific Contribution.